



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 417

Waiver of Flight Termination Receiver Qualification by Similarity Deficiencies

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT)

ACTION: Notice of waiver.

SUMMARY: This notice concerns three petitions for waiver submitted to the FAA by Rocket Lab USA Inc. (RL) for the Flight Termination Receiver (FTR) Qualification by Similarity (QBS): a petition to waive the requirement that a component may be qualified based on similarity to a component that has already been qualified for use only if the environments encountered by the previously qualified component during its qualification or flight history were equal or more severe than the Rocket Lab qualification environments; a petition to waive the Electromagnetic Interference and Compatibility (EMI/EMC) on the same units; and a petition to waive the requirement that the same manufacturer must produce the qualified and the unqualified component in the same location using identical tools and manufacturing processes. The FAA grants these three petitions.

DATES: Issued in Washington, DC, on May 15, 2017.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this waiver, contact Michael Wiktowy, Licensing Program Lead, Commercial Space Transportation - Licensing and Evaluation Division, 800 Independence Avenue S.W., Washington, DC 20591; telephone: (202) 267-7287; email: Michael.Wiktowy@faa.gov.

SUPPLEMENTARY INFORMATION:

Background

RL submitted a petition to the FAA's Office of Commercial Space Transportation (AST) requesting relief from regulatory requirements for a launch license for flight of Electron test flight missions from Mahia, New Zealand. Specifically, RL requested relief from 14 CFR E417.7(f)(2) and (5), Qualification Testing and Analysis by Similarity for the Flight Termination Receiver. For Qualification, the Flight Termination Receiver is required to meet Table E417.19-2, which states with note (5): "The same three sample components must undergo each test designated with an X. For a test designated with a quantity of less than three, each sample component tested must be one of the original three sample components." For Qualification Testing and Analysis by Similarity, Part 417 Appendix E section 417.7(f) provides the requirements a launch operator must satisfy in order to qualify or re-qualify a flight termination system component's design through qualification by similarity to tests performed on identical or similar hardware. Section E417.7(f)(2) states that to qualify component "A" based on similarity to component "B", that has already been qualified for use, a launch operator must demonstrate that the environment encountered by "B" must have been equal to or more severe than the qualification environments required for "A". Specifically, RL used different components for the random vibration qualification test and the EMI/EMC qualification test instead of the original three qualification sample components used for the other tests under E417.7(f)(2). Section E417.7(f)(5) requires that the same manufacturer produce "A" and "B" in the same location using identical tools and manufacturing processes. Specifically, RL's sample "A" and "B" were manufactured at different locations with different manufacturing processes.

The FAA licenses the launch of a launch vehicle and reentry of a reentry vehicle under authority granted to the Secretary of Transportation in the Commercial Space Launch Act of 1984, as amended and re-codified by 51 U.S.C. Subtitle V, chapter 509 (Chapter 509), and delegated to the FAA

Administrator and the Associate Administrator for Commercial Space Transportation, who exercises licensing authority under Chapter 509.

RL is a private commercial space flight company. RL seeks to lower the cost and increase the frequency of access to space for small payloads, potentially expanding the opportunity for space services and research. RL's petition for waiver addresses all upcoming Electron test flights that RL plans to launch from the Mahia Peninsula, New Zealand. The Electron launch is the first planned test flight from the privately-owned Rocket Lab Launch Complex at Mahia Peninsula in Hawkes Bay, New Zealand. The launch location is capable of hosting launches to the northeast, east, and south. The area within 20 NM surrounding the launch site is extremely remote, and has a low population density. The launch flight corridor will have minimal impact on air and marine traffic.

Waiver Criteria

Chapter 509 allows the FAA to waive a license requirement if the waiver (1) will not jeopardize public health and safety, safety of property; (2) will not jeopardize national security and foreign policy interests of the United States; and (3) will be in the public interest. See 51 U.S.C. 50905(b)(3) (2011); 14 CFR 404.5(b) (2011).

Section E417.7(f)(2) and (5) Waiver Petition

Section E417.7(f)(2) requires a launch operator wishing to qualify a component's design through qualification by similarity to tests performed on identical or similar hardware to demonstrate that the environments encountered by the component during its qualification or flight history were equal to or more severe than the qualification environments required for a component that has already been qualified for use. Section E417.7(f)(5) requires a launch operator qualifying a component's design as discussed above to demonstrate that the same manufacturer produced both the qualified component and the component the launch operator wishes to qualify in the same location using identical tools and

manufacturing processes. For reasons described below, the FAA waives the requirements in section E417.7(f)(2) and (5) to allow RL to use components in its flight termination system that were qualified by similarity to more than one qualified component.

In deciding whether or not to issue a waiver, the FAA had to analyze whether the waiver: (1) would jeopardize public health and safety or safety of property; (2) would jeopardize national security and foreign policy interests of the United States; and (3) was in the public interest. See 51 USC 50905(b)(3); 14 CFR 404.5(b).

i. Public Health and Safety and Safety of Property

Part 417 contains requirements for qualification and acceptance testing of flight termination system components based on the approach used at the federal launch ranges. At federal launch ranges, flight termination system components are tested according to federal range-approved test procedures and requirements. Verification methods include test, analysis, and inspection. As an alternative to testing, components of an FTS are sometimes qualified by similarity. A component that has been qualified through testing for one launch vehicle may be approved for use on a different launch vehicle if it can be shown that the environments in which it must operate on the second vehicle are no harsher than those of the first. Also, with limited additional testing, the component may be qualified for a more severe environment. Although RL did not complete each of the qualification by similarity requirements for its flight termination receiver as required by the regulations, the failsafe design of the Electron's flight termination system combined with the remoteness of the operating area allow the FAA to find that RL's activities will not jeopardize public health and safety and safety of property.

RL procured the Electron launch vehicle's flight termination receiver from Vendor A, who performed several qualification and delta qualification tests. A delta qualification test extends the tested environments to cover specific tests or levels that were not previously covered. RL submitted a

Qualification by Similarity Analysis Report to the FAA, referencing three previous groups of similar flight termination receiver qualification and delta qualification tests performed by Vendor A. Group 1 was subjected to most of the qualification testing required by 14 CFR Table E417.19-2, with three exceptions: a) Group 1 did not satisfy 14 CFR E417.7(f)(2) because the random vibration qualification environment encountered by Group 1 was not equal to or more severe than the random vibration qualification environment required for the Electron flight termination receivers, falling below for approximately 3.5% over the required 20 Hz to 2000 Hz test band; b) Group 1 was not subjected to EMI/EMC testing; and c) Group 1 did not meet the requirements of 14 CFR E417.7(f)(5) because it was not produced in the same manufacturing location using identical tools and manufacturing processes as the Rocket Lab Electron flight termination receivers. Group 1's deficiencies were mitigated by two subsequent delta qualification tests on 2 groups (referred to herein as Group 2 and Group 3) of similar receivers. Group 2 satisfied Electron's required random vibration qualification test levels for the entire required test band, and Group 2 was manufactured in the same location using identical tools and manufacturing processes as Electron flight termination receivers. Group 3 successfully passed EMI/EMC qualification testing.

Group 1 also did not meet the requirements of 14 CFR E417.7(f)(5) because Group 1 was not produced in the same manufacturing location using identical tools and manufacturing processes as Group 2 and Electron flight termination receivers. Vendor A originally outsourced one of the flight termination receiver's printed circuit boards to another supplier. In late 2013, Vendor A upgraded its internal equipment and process, and assembled the printed circuit boards in-house. Group 1 and Group 3 were manufactured and qualification tested before this change in equipment and process, whereas Group 2 and Electron's flight termination receivers were assembled after the change. To verify that the equipment and process change did not invalidate previous qualification and delta qualification testing,

Vendor A applied the same heritage process profile to the new equipment, retained heritage printed circuit board samples for periodic process control comparisons, and implemented periodic visual/x-ray inspections for consistency validation. Heritage and new equipment specifications were also assessed to compare their performance characteristics. White Sand Missile Range has reviewed and accepted this process change, for U.S. Government launch vehicle programs conducting launches from its launch range, based on improved reliability and quality of the process.

The FAA waives the requirements of E417.7(f)(2) and (5) because the Electron has implemented a failsafe flight safety system design that would terminate thrust to the vehicle should both flight termination receivers fail or communication was lost with the ground station, and RL's operating area is remote enough that were it to experience a catastrophic failure, it would not jeopardize public health and safety and safety of property. The Electron test flight missions would occur from the isolated Mahia Peninsula in New Zealand. The area within 20 NM of Mahia Peninsula has a very low population density. The Electron flight corridor is over the broad ocean area with minimal impact on air and marine traffic. Consequence analysis showed that less than 1 in 100,000 casualties would be expected if the worst foreseeable vehicle response mode (i.e., where the vehicle guidance is assumed to fail in a manner that leads to an attempt to guide to erroneous, randomly located points) occurred at the worst flight time (relatively early in flight before the vehicle proceeds downrange) and the flight termination receiver failed to activate. Thus, the casualty expectation given the assumption of the worst possible failure would on average still produce significantly less casualties than the FAA's limit of 1 in 10,000, which does not assume failure but rather assigns realistic failure probabilities. Also, the flight termination receiver's failsafe feature will terminate thrust if there is a loss of power or Radio Frequency carrier or pilot tone signal, providing an additional safety margin. For these reasons, the FAA has determined that

waiving sections E417.7(f)(2) and (5) for the Electron test flight missions from Mahia, New Zealand will not jeopardize public health and safety or safety of property.

ii. National Security and Foreign Policy Implications

The FAA has identified no national security or foreign policy implications associated with granting this waiver.

iii. Public Interest

The waiver is consistent with the public interest goals of Chapter 509 and the National Space Transportation Policy. Three of the public policy goals of Chapter 509 are: (1) To promote economic growth and entrepreneurial activity through use of the space environment; (2) to encourage the United States private sector to provide launch and reentry vehicles and associated services; and (3) to facilitate the strengthening and expansion of the United States space transportation infrastructure to support the full range of United States space-related activities. See 51 U.S.C. 50901(b)(1), (2), (4).

RL seeks to lower the cost and increase the frequency of access to space for small payloads, potentially expanding the opportunity for space services and research. These activities will help to make the U.S. launch industry more competitive internationally. The National Space Transportation Policy states that strengthening U.S. competitiveness in the international launch market and improving the cost effectiveness of U.S. space transportation services are in the public interest:

Maintaining an assured capability to meet United States Government needs, while also taking the necessary steps to strengthen U.S. competitiveness in the international commercial launch market, is important to ensuring that U.S. space transportation capabilities will be reliable, robust, safe, and affordable in the future. Among other steps, improving the cost effectiveness of U.S. space transportation services could help achieve this goal by allowing the United States Government to invest a greater share of its resources in other needs such as facilities modernization, technology advancement,

scientific discovery, and national security. Further, a healthier, more competitive U.S. space transportation industry would facilitate new markets, encourage new industries, create high technology jobs, lead to greater economic growth and security, and would further the Nation's leadership role in space.

More specifically, Rocket Lab will be carrying onboard the Electron launch vehicle on its inaugural launch a flight test experiment for NASA Kennedy Space Center which will improve public risk mitigation capabilities from an errant launch vehicle. This component is designed and manufactured by NASA KSC and is part of the independent safety system which will be installed on the launch vehicles. This safety system will be capable of determining if the flight of the launch vehicle will pose an unacceptable increased risk to the public based on mission rules designed for its unique vehicle and flight characteristics and programmed into the safety system and terminate the flight of such launch vehicle. This type of capability is in public interest because this safety system will allow for improved protection of the public from mishaps resulting from flight of errant launch vehicles.

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